PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-206013

(43)Date of publication of application : 31.07.2001

(51)Int.Cl. B60C 11/00
B60C 9/22

(21)Application number : 2000-016509

(22)Date of filing : 26.01.2000

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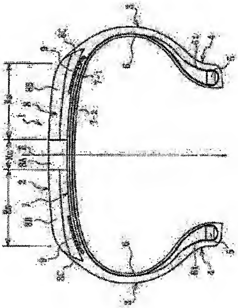
(54) PNEUMATIC TIRE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a pneumatic tire simultaneously improving three performances, rolling resistance performance, compartment noise(R/N) performance, and straight running maneuvering stability performance.

SOLUTION: Tread rubber has a center region rubber across a tire equator face and different types of both-side region rubbers continued thereto, the both- side region rubber has a composite rubber layer constitution of an outer rubber layer and a different type inner rubber layer, a dynamic storage elasticity EA' of the center region rubber has a larger value than the dynamic storage elasticity EB' of the outer rubber layer, and the inner rubber layer has the physical property tan δ0.1 or less.



CLAIMS

[Claim(s)]

[Claim 1]A radial carcass reinforced over between [which has a tread part, and a sidewall part of a couple and a bead part of a couple which stand in a row on the both sides, and laid these each part underground in a bead part] bead cores, In a pneumatic tire which has tread rubber which is provided with a belt which strengthens a tread part with a periphery of this radial carcass, and constitutes a tread part from two or more sorts of rubber compositions, Have tread rubber and center region rubber which faces across a tire equatorial plane, and both-sides field rubber of another kind which stands in a row to this rubber this both-sides field rubber, a rubber layer of a method of the outside of a tire radial direction -- among those, it having composite rubber lamination with an another kind rubber layer of a direction, and under temperature of 30 **, frequency of 50 Hz, and a test condition of 1% of a dynamic strain, A dynamic storage modulus (E_A') of center region rubber, A pneumatic tire, wherein it compares with a dynamic storage modulus (E_B') of a way rubber layer outside a both-sides field, it has a bigger value and an inner direction rubber layer of a both-sides field has physical properties whose tandelta on temperature of 60 **, frequency of 50 Hz, and a test condition of 1% of a dynamic strain is 0.1 or less.

[Claim 2]A tire indicated to Claim 1 which compares a dynamic storage modulus (E_B') of a way rubber layer with a dynamic storage modulus (E_C') of an inner direction rubber layer outside a both-sides field, and has a bigger value under a test condition of the above-mentioned dynamic storage modulus.

[Claim 3]A tire indicated to Claim 1 in which center region rubber has a dynamic storage modulus (E_A') of 12 or more MPa under a test condition of the above-mentioned dynamic storage modulus, and a way rubber layer has a dynamic storage modulus (E_B') of 11 or less MPa outside a both-sides field, or 2.

[Claim 4]A tire indicated in any 1 paragraph of Claims 1-3 in which a method rubber layer of outside occupies a gauge of 60 to 90% of within the limits, and an inner direction rubber layer occupies a gauge of 10 to 40% of within the limits to a tread rubber gauge of a both-sides field.

[Claim 5]A tire which indicated center region rubber in any 1 paragraph of Claims 1-4 which have the tread part width of 10 to 20% of within the limits of grounding width of a tread part.

[Claim 6]A tire which indicated a belt to Claim 1 which has a tread part hoop direction arrangement organic fiber code layer more than a wrap couple for a both-sides end of a code intersection layer more than two-layer, and this code intersection layer from a method of the outside of a tire radial direction.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]Especially this invention relates to the pneumatic tire which raised rolling-resistance performance, a sound (it is called a load noise and following R/N) in the car, and rectilinear-propagation steering stability about a pneumatic tire and the radial-ply tire containing air with which a passenger car, a light truck, etc. present the purpose for spending of a compact vehicle comparatively more at details.
[0002]
[Description of the Prior Art]The pneumatic tire used for the compact vehicle described at the beginning is required to be in the level excellent in each of many performances, such as rolling-resistance performance, a sound (R/N) in the car, and rectilinear-propagation steering stability. Therefore, many of many of these improved efficiency means are proposed conventionally.
[0003]For example, a means to apply what is called a cap/base structure to tread rubber is well known as a rolling-resistance improved efficiency means, i.e., a low rolling-resistance-ized means. . This structure makes tread rubber two-layer, and excel in the cap rubber of an outer layer at wet performance or towage performance. Rubber with a comparatively large value of tandelta is applied, the value of tandelta is comparatively small, for example, a hysteresis loss is a small thing for which tandelta appropriates 0.1 or less rubber at 60 ** at base rubber of a inner layer.
[0004]It is the fact which the tire provided with the tread rubber of this cap/base structure has contributed to low rolling-resistance-ization as it is. However, shear rigidity is low, as a result when transmitting the grip force received by the tread of a tread part to a belt, a time lag arises, and base rubber for realizing sufficient low rolling-resistance performance brings about rectilinear-propagation steering stability and the fault to which the steering performance in a minute steering angle falls especially.
[0005]The above-mentioned cap/base structure are crossed to tread part overall width, and a means to apply a cap/base structure only to the tread rubber portion of the part both-sides field except a tread part center region in addition to this is also known. This another structure is proposed from the contribution of rolling resistance of the shoulder region of a tread part being high.
[0006]Rubber with low hardness or dynamic-storage-modulus E' is small to the above-mentioned cap rubber, for example, it is proposed by the reduction means of the sound (R/N) in the car, for example that E' applies the rubber of 11 or less MPa at 30 **. However, even if it uses cap rubber, it has the problem of the transfer lag of the power which base rubber still mentioned above. If high hardness rubber thru/or high dynamic-storage-modulus E' rubber are applied to cap rubber for this problem solving, the problem to which oscillating riding comfortability performance and rolling-resistance performance fall will arise.
[0007]As a reduction means of other sounds (R/N) in the car, a way is covered by the reinforcement cord layer of a special couple outside the both-sides end of a belt, the structure which strengthens a belt both-sides end is proposed, and it is known that this structure is effective in in-the-car sound (R/N) reduction. However, since the rigidity of a belt center section compares with the rigidity of a side part and becomes smaller, this kind of strengthening belt structure is accompanied by the problem that rectilinear-propagation steering stability falls.
[0008]
[Problem(s) to be Solved by the Invention]In conventional technology, as explained in full detail above, if it is going to raise one performance in rolling-resistance performance, a sound (R/N) in the car, and rectilinear-propagation steering stability, the problem that residual performance degradation is obliged arises, and a means to solve this problem completely is desired today.
[0009]Therefore, an object of especially the invention indicated to the Claims 1-6 of this invention is

to provide the pneumatic tire which was described at the beginning and which can raise simultaneously three performances of rolling-resistance performance, a sound (R/N) in the car, and rectilinear-propagation steering stability about the pneumatic tire of a compact vehicle comparatively.

[0010]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, an invention indicated to Claim 1 of this invention, A radial carcass reinforced over between [which has a tread part, and a sidewall part of a couple and a bead part of a couple which stand in a row on the both sides, and laid these each part underground in a bead part] bead cores, In a pneumatic tire which has tread rubber which is provided with a belt which strengthens a tread part with a periphery of this radial carcass, and constitutes a tread part from two or more sorts of rubber compositions, Have tread rubber and center region rubber which faces across a tire equatorial plane, and both-sides field rubber of another kind which stands in a row to this rubber this both-sides field rubber, a rubber layer of a method of the outside of a tire radial direction — among those, it having composite rubber lamination with an another kind rubber layer of a direction, and under temperature of 30 **, frequency of 50 Hz, and a test condition of 1% of a dynamic strain, Dynamic-storage-modulus E_A' of center region rubber, It compares with dynamic-storage-modulus E_B' of a way rubber layer outside a both-sides field, and has a bigger value, and an inner direction rubber layer of a both-sides field is a pneumatic tire, wherein tandelta on temperature of 60 **, frequency of 50 Hz, and a test condition of 1% of a dynamic strain has physical properties which are 0.1 or less.

[0011]It is a value calculated in accordance with a method by which above-mentioned dynamic-storage-modulus E_A', E_B', and tandelta were indicated to a test method of JIS K 7198 (1991) here. The same may be said of dynamic-storage-modulus E_C' described below.

[0012]About an invention indicated to Claim 1, like an invention indicated to Claim 2, dynamic-storage-modulus E_B' of a way rubber layer is compared with dynamic-storage-modulus E_C' of an inner direction rubber layer, and has a bigger value outside a both-sides field under a test condition of the above-mentioned dynamic storage modulus.

[0013]About Claim 1 and an invention indicated to 2, like an invention indicated to Claim 3, center region rubber has dynamic-storage-modulus E_A' of 12 or more MPa under a test condition of the above-mentioned dynamic storage modulus, and a way rubber layer has dynamic-storage-modulus E_B' of 11 or less MPa outside a both-sides field.

[0014]Like an invention indicated to Claim 4 about an invention indicated to Claims 1-3, Like an invention indicated to Claim 5 about an invention which a method rubber layer of outside occupied a gauge of 60 to 90% of within the limits, and an inner direction rubber layer occupied a gauge of 10 to 40% of within the limits to a tread rubber gauge of a both-sides field, and was indicated to Claims 1-4, Center region rubber has the tread part width of 10 to 20% of within the limits of grounding width of a tread part. According to grounding width indicated to be grounding width here to JATMA YEAR BOOK (1999), a chapter of general information, and a definition of term, pneumatic pressure of regulation in description considers it as the highest pneumatic pressure corresponding to maximum load capacity, and regular mass is made into maximum load capacity. It is below the same.

[0015]A belt is provided with the following like an invention indicated to Claim 6 about an invention indicated to Claim 1.

A code intersection layer more than two-layer.

It is a tread part hoop direction arrangement organic fiber code layer more than a wrap couple from a method of the outside of a tire radial direction about a both-sides end of this code intersection layer.

[0016]

[Embodiment of the Invention]Hereafter, this embodiment of the invention is described based on drawing 1. Drawing 1 is a sectional view of the pneumatic tire of this invention. The pneumatic tire (henceforth a tire) 1 is provided with the following in drawing 1.

Tread part 2.

The sidewall part 3 of a couple and the bead part 4 of a couple which stand in a row on the both sides.

[0017]The tire 1 is provided with the following.

One or more plies and the example of a graphic display which are prolonged over between [which was laid underground in the bead part 4] bead core 5 are the radial carcasses 6 of 1 ply.

It is the belt 7 to the periphery of the radial carcass 6.
The radial carcass 6 reinforces each part 2-4 of the above, and the belt 7 strengthens the tread part 2. The radial carcass 6 comprises the ply which becomes the rubber covering radial arrangement of organic fiber codes, such as nylon cords, a polyester cord, and a rayon code. The radial carcass 6 shown in drawing 1 is provided with the folded section 6t which turns up the surroundings of the bead core 5 outside from the inside of the tire 1.

[0018]The tread part 2 is provided with the tread rubber 8 constituted from two or more sorts of rubber compositions. The tread rubber 8 is provided with the following.
Rubber 8A of the center region Rc which sandwiches tire equatorial plane E.
Rubbers 8B and 8C of the both-sides field Rs.
The rubbers 8B and 8C stand in a row to the rubber 8A along tread part 2 hoop direction. The rubbers 8A, 8B, and 8C comprise the rubber composition of another kind, respectively. the rubbers 8B and 8C of the both-sides field Rs -- the rubber layer 8B of the method of the outside of a radial direction (henceforth a radial direction) of the tire 1 -- among those, it shall have composite rubber lamination with the rubber layer 8C of a direction The rubber 8A consists of a single rubber composition, and couples directly the rubber 8A and the rubber layer 8C with the belt 7.

[0019]The relation of the dynamic storage modulus described below between the way rubber layers 8B shall be realized here outside the rubber 8A of the center region Rc, and the both-sides field Rs. That is, under the temperature of 30 **, the frequency of 50 Hz, and the test condition of 1% of a dynamic strain, dynamic-storage-modulus E_A' of the rubber A of the center region Rc is compared with dynamic-storage-modulus E_B' of the way rubber layer 8B outside the both-sides field Rs, and has a bigger value.

[0020]The inner direction rubber layer 8C of the both-sides field Rs shall have physical properties whose tandelta on the temperature of 60 **, the frequency of 50 Hz, and the test condition of 1% of a dynamic strain is 0.1 or less. At this point, the inner direction rubber layer 8C is equivalent to conventional base rubber, and therefore, outside the both-sides field Rs, dynamic-storage-modulus E_B' of the way rubber layer 8B shall be compared with dynamic-storage-modulus E_C' of the inner direction rubber layer 8C, and shall have a bigger value.

[0021]Now, when slip angle 1 degree is given to the slick tire which rolls under loading, The relation between the grounding width position of tread part 2 tread to ground and the lateral force (side force) to generate is solved by actual Measurement Division, the lateral force generated in a grounding center region so that clearly from drawing 2 in which the result is shown as a plot diagram compares with the lateral force generated in a both-ends field, and it turns out that it is remarkably large. The lateral force generated as the whole tire is expressed with the area (N) surrounded by a plot diagram. The numerals e are the straight lines on a tire equatorial plane.

[0022]The tire 1 provided with the tread rubber 8 described above, First, based on the plot diagram shown in drawing 2, since dynamic-storage-modulus E_A' of the rubber 8A of the center region Rc of the tread rubber 8 is the maximum in the tread rubber 8, it turns out that it can generate and the lateral force at a minute steering angle with the big tire 1 is excelled in rectilinear-propagation steering stability.

[0023]Next, the input from a portion with high tread ground pressure of the tread part 2 under the loading of the tire 1 had influence dominantly, and in the case of the radial ply tire, the ground pressure of the both-sides field Rs compared with it of the center region Rc, and, as for the sound (R/N) in the car, solved the higher thing.

[0024]Therefore, even if the affecting degree to a sound (R/N) in the car arranges the rubber A of high dynamic-storage-modulus E_A' to the small center region Rc, Outside the both-sides field Rs, dynamic-storage-modulus E_B' of the way rubber layer 8B and dynamic-storage-modulus E_C' of the inner direction rubber layer 8C compare with dynamic-storage-modulus E_A' of the rubber A of the center region Rc, and are alike in it being a smaller value, and an in-the-car sound (R/N) level reduces the tire 1 more.

[0025]Even if it finally arranges the rubber 8A of high dynamic-storage-modulus E_A' to the center region Rc, The method rubber layer 8B of outside absorbs the rolling-resistance increment, and further dynamic-storage-modulus E_C' of the inner direction rubber layer 8C of the both-sides field Rs, When it compares with dynamic-storage-modulus E_B' of the way rubber layer 8B outside the both-sides field Rs, and it is a smaller value and tandelta of the inner direction rubber layer 8C is 0.1 or less, low rolling-resistance performance of the tire 1 improves.

[0026]As stated above, the tire 1 provided with the tread rubber 8 can raise these 3 performance simultaneously, without making all of three performances of rolling-resistance performance, a sound (R/N) in the car, and rectilinear-propagation steering stability into a sacrifice.
[0027]As for the value of each upper dynamic storage modulus, that the rubber 8A of the center region Rc has dynamic-storage-modulus E_A' of 12 or more MPa, and the way rubber layer 8B has dynamic-storage-modulus E_B' of 11 or less MPa outside the both-sides field Rs under the above-mentioned test condition actually suits the improvement in simultaneous of said three performances. Especially application of the rubber 8A of the center region Rc with dynamic-storage-modulus E_A' of 12 or more MPa demonstrates the rectilinear-propagation steering stability which can be detected also with a common driver.
[0028]Here, in less than 12 MPa, since rectilinear-propagation steering stability, especially the rectilinear-propagation steering stability in a minute steering angle fall here, dynamic-storage-modulus E_A' of the rubber 8A of the center region Rc is improper. If dynamic-storage-modulus E_B' of the way rubber layer 8B exceeds 11MPa outside the both-sides field Rs, since rolling resistance will increase and an in-the-car sound (R/N) level will go up, it is improper.
[0029]That the method rubber layer 8B of outside occupies the gauge of 60 to 90% of within the limits, and the inner direction rubber layer 8C occupies the gauge of 10 to 40% of within the limits to the gauge of the tread rubber 8 in the both-sides field Rs suits the improvement in simultaneous of said three performances.
[0030]Since rolling resistance will increase if rectilinear-propagation steering stability falls [the rate over the gauge of the tread rubber 8] here at less than 60% about the gauge of the method rubber layer 8B of outside and a rate exceeds 90%, all are improper. Since rectilinear-propagation steering stability will fall if rolling resistance increases in less than 10% in the rate over the gauge of the tread rubber 8 and a rate exceeds 40% about the gauge of the inner direction rubber layer 8C, all are improper.
[0031]The rubber 8A of the center region Rc shall have two tread parts of 10 to 20% of within the limits of the grounding width (previous explanation is followed) of the tread part 2. It is the width of the center region Rc shown in this width, i.e., drawing 1, and each **** is located on a flat surface parallel to tire equatorial plane E. Thereby, the improvement in simultaneous of said three performances will become much more positive.
[0032]Since rolling-resistance performance and a sound (R/N) in the car will stop at undesirable performance if it becomes insufficient [less than 10% of the grounding width of the tread part 2] rectilinear-propagation steering stability's improving the rubber 8A of the center region Rc and it exceeds 20% here, all are improper.
[0033]In order to aim at reduction of a sound (R/N) in the car further, here, As shown in drawing 1, as for the belt 7, having the tread part 2 hoop-direction arrangement rubber covering organic fiber code layer 9 more than a wrap couple (the example of a graphic display is a couple) from the method of the outside of a tire radial direction suits the code intersection layer 7-1 more than two-layer (the example of a graphic display is two-layer), 7-2, and the code intersection layer 7-1 and the both-sides end of 7-2.
[0034]The rubber coated cord of each class points out the laminated constitution which crosses mutually on both sides of tire equatorial plane E in the code intersection layer 7-1 and 7-2, and a steel cord suits this code. Preferably the hoop direction arrangement organic fiber code layer 9 one or more Two or more organic fiber codes, For example, suppose that it is good either to consider it as the layer which carried out spiral winding of the strip whose width, such as nylon cords, a polyester cord, and a rayon code, is 4-15 mm, or to use the layer of the prescribed width of the cord layer 9 as winding and the layer made to overlap. Even if it uses this cord layer 9, rectilinear-propagation steering stability does not fall to the center region Rc of the tread rubber 8 by applying the rubber 8A.
[0035]
[Example]With the radial ply tire for passenger cars, sizes are 205/65R15 and composition applies to the place shown in drawing 1 correspondingly. The radial carcass 6 has 1 ply which arranged the polyester cord of the rubber covering 1500D/2 at about 90 degrees to the equatorial plane E of the tire 1. The belt 7 has the two-layer code intersection layer 7-1, and 7-2 and the top hoop direction arrangement organic fiber code layer 9 of a couple.
[0036]The code intersection layer 7-1 and the code of 7-2 applied the steel cord of 1x3x0.23 structure, and each steel cord was taken as 22-degree tilted arrangement to tire equatorial plane E. The cord layer 9 is two-layer [which carried out spiral winding of the strip which put in order five

nylon cords of 1260D/2].
[0037]The tread rubber 8 was considered as the following composition.
Width of the center region Rc : (1) 42.5% of the width:grounding width of 15% of grounding width, and the both-sides field Rs. (2) Dynamic-storage-modulus E_B':9MPa of dynamic-storage-modulus E_A':20MPa of the rubber A, and the (3) rubber layer 8B, (4) The gauge ratio of gauge ratio:75% of the rubber layers 8B to tandelta:0.1 of the dynamic-storage-modulus E_C':3MPa (5) rubber layer 8C of the rubber layer 8C, and the gauge of the (6) tread rubber 8, and the rubber layer 8C : 25%.
However, each dynamic-storage-modulus E_A', E_B', E_C', and tandelta were measured using the spectrometer made from Oriental energy machinery.
[0038]In order to evaluate the effect of the working example tire, the conventional example tire which tread rubber was removed and also was doubled with the working example tire was prepared. The tread rubber of the conventional example tire was made into a cap/base structure, the same rubber as the rubber layer 8B of the working example tire was applied to the cap, and the same rubber as the rubber layer 8C of the working example tire was applied to the base.
[0039]The three following kinds of tests were carried out by using the tire of the two above-mentioned examples as a sample offering tire.
(1) Rolling-resistance test : it is filled up with internal pressure 200kPa, press each tire against the drum 1.7 m in diameter which rotates at 60 km/h under the load of load 4.9kN, and measure rolling resistance. Expressing the measurement result with the index which sets a conventional example tire to 100, the value presupposed that smallness I see is good.
(2) In-the-car sound (R/N) test : all the rings of the passenger car of the displacement 2.5L were equipped, and the sound (R/N) in the car in the front seat when it runs the asphalt road surface top containing a ball of a test course at 40 km/h was measured. Expressing the measurement result with the index which sets a conventional example tire to 100, the value presupposed that smallness I see is good.
(3) Rectilinear-propagation steering stability test : all the rings of the passenger car of the displacement 2.5L were equipped, and grading evaluation of the conventional example tire was carried out as the index set to 100 with the feeling when run the highway top at 80-100 km/h. Size I see of a value is good.
[0040]85 and a sound (R/N) in the car are [90 and the rectilinear-propagation steering stability of the index number of the working example tire by the above-mentioned test result of rolling resistance] 105. this result to the working example tire — any of three performances of rolling-resistance performance, in-the-car sound (R/N) performance, and rectilinear-propagation steering stability — although -- it turns out that it is improving simultaneously.
[0041]
[Effect of the Invention]According to the invention indicated to the Claims 1-6 of this invention, the pneumatic tire which can raise simultaneously each of three performances of rolling-resistance performance, in-the-car sound (R/N) performance, and rectilinear-propagation steering stability can be provided.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]Especially this invention relates to the pneumatic tire which raised rolling-resistance performance, a sound (it is called a load noise and following R/N) in the car, and rectilinear-propagation steering stability about a pneumatic tire and the radial-ply tire containing air with which a passenger car, a light truck, etc. present the purpose for spending of a compact vehicle comparatively more at details.

[Translation done.]

* NOTICES *

JPO and INPIT are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art]The pneumatic tire used for the compact vehicle described at the beginning is required to be in the level excellent in each of many performances, such as rolling-resistance performance, a sound (R/N) in the car, and rectilinear-propagation steering stability. Therefore, many of many of these improved efficiency means are proposed conventionally.
[0003]For example, a means to apply what is called a cap/base structure to tread rubber is well known as a rolling-resistance improved efficiency means, i.e., a low rolling-resistance-ized means. . This structure makes tread rubber two-layer, and excel in the cap rubber of an outer layer at wet performance or towage performance. Rubber with a comparatively large value of tandelta is applied, the value of tandelta is comparatively small, for example, a hysteresis loss is a small thing for which tandelta appropriates 0.1 or less rubber at 60 ** at base rubber of a inner layer.
[0004]It is the fact which the tire provided with the tread rubber of this cap/base structure has contributed to low rolling-resistance-ization as it is. However, shear rigidity is low, as a result when transmitting the grip force received by the tread of a tread part to a belt, a time lag arises, and base rubber for realizing sufficient low rolling-resistance performance brings about rectilinear-propagation steering stability and the fault to which the steering performance in a minute steering angle falls especially.
[0005]The above-mentioned cap/base structure are crossed to tread part overall width, and a means to apply a cap/base structure only to the tread rubber portion of the part both-sides field except a tread part center region in addition to this is also known. This another structure is proposed from the contribution of rolling resistance of the shoulder region of a tread part being high.
[0006]Rubber with low hardness or dynamic-storage-modulus E' is small to the above-mentioned cap rubber, for example, it is proposed by the reduction means of the sound (R/N) in the car, for example that E' applies the rubber of 11 or less MPa at 30 **. However, even if it uses cap rubber, it has the problem of the transfer lag of the power which base rubber still mentioned above. If high hardness rubber thru/or high dynamic-storage-modulus E' rubber are applied to cap rubber for this problem solving, the problem to which oscillating riding comfortability performance and rolling-resistance performance fall will arise.
[0007]As a reduction means of other sounds (R/N) in the car, a way is covered by the reinforcement cord layer of a special couple outside the both-sides end of a belt, the structure which strengthens a belt both-sides end is proposed, and it is known that this structure is effective in in-the-car sound (R/N) reduction. However, since the rigidity of a belt center section compares with the rigidity of a side part and becomes smaller, this kind of strengthening belt structure is accompanied by the problem that rectilinear-propagation steering stability falls.

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EFFECT OF THE INVENTION

[Effect of the Invention]According to the invention indicated to the Claims 1-6 of this invention, the pneumatic tire which can raise simultaneously each of three performances of rolling-resistance performance, in-the-car sound (R/N) performance, and rectilinear-propagation steering stability can be provided.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]In conventional technology, as explained in full detail above, if it is going to raise one performance in rolling-resistance performance, a sound (R/N) in the car, and rectilinear-propagation steering stability, the problem that residual performance degradation is obliged arises, and a means to solve this problem completely is desired today.
[0009]Therefore, an object of especially the invention indicated to the Claims 1-6 of this invention is to provide the pneumatic tire which was described at the beginning and which can raise simultaneously three performances of rolling-resistance performance, a sound (R/N) in the car, and rectilinear-propagation steering stability about the pneumatic tire of a compact vehicle comparatively.

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* NOTICES *

MEANS

[Means for Solving the Problem]In order to attain the above-mentioned purpose, an invention indicated to Claim 1 of this invention, A radial carcass reinforced over between [which has a tread part, and a sidewall part of a couple and a bead part of a couple which stand in a row on the both sides, and laid these each part underground in a bead part] bead cores, In a pneumatic tire which has tread rubber which is provided with a belt which strengthens a tread part with a periphery of this radial carcass, and constitutes a tread part from two or more sorts of rubber compositions, Have tread rubber and center region rubber which faces across a tire equatorial plane, and both-sides field rubber of another kind which stands in a row to this rubber this both-sides field rubber, a rubber layer of a method of the outside of a tire radial direction -- among those, it having composite rubber lamination with an another kind rubber layer of a direction, and under temperature of 30 **, frequency of 50 Hz, and a test condition of 1% of a dynamic strain, Dynamic-storage-modulus E_A' of center region rubber, It compares with dynamic-storage-modulus E_B' of a way rubber layer outside a both-sides field, and has a bigger value, and an inner direction rubber layer of a both-sides field is a pneumatic tire, wherein tandelta on temperature of 60 **, frequency of 50 Hz, and a test condition of 1% of a dynamic strain has physical properties which are 0.1 or less.

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It is a tread part hoop direction arrangement organic fiber code layer more than a wrap couple from a method of the outside of a tire radial direction about a both-sides end of this code intersection layer.

[0016]

[Embodiment of the Invention]Hereafter, this embodiment of the invention is described based on drawing 1. Drawing 1 is a sectional view of the pneumatic tire of this invention. The pneumatic tire (henceforth a tire) 1 is provided with the following in drawing 1.

Tread part 2.
The sidewall part 3 of a couple and the bead part 4 of a couple which stand in a row on the both sides.

[0017]The tire 1 is provided with the following.
One or more plies and the example of a graphic display which are prolonged over between [which was laid underground in the bead part 4] bead core 5 are the radial carcasses 6 of 1 ply.
It is the belt 7 to the periphery of the radial carcass 6.
The radial carcass 6 reinforces each part 2-4 of the above, and the belt 7 strengthens the tread part 2. The radial carcass 6 comprises the ply which becomes the rubber covering radial arrangement of organic fiber codes, such as nylon cords, a polyester cord, and a rayon code. The radial carcass 6 shown in drawing 1 is provided with the folded section 6t which turns up the surroundings of the bead core 5 outside from the inside of the tire 1.
[0018]The tread part 2 is provided with the tread rubber 8 constituted from two or more sorts of rubber compositions. The tread rubber 8 is provided with the following.
Rubber 8A of the center region Rc which sandwiches tire equatorial plane E.
Rubbers 8B and 8C of the both-sides field Rs.
The rubbers 8B and 8C stand in a row to the rubber 8A along tread part 2 hoop direction. The rubbers 8A, 8B, and 8C comprise the rubber composition of another kind, respectively. the rubbers 8B and 8C of the both-sides field Rs -- the rubber layer 8B of the method of the outside of a radial direction (henceforth a radial direction) of the tire 1 -- among those, it shall have composite rubber lamination with the rubber layer 8C of a direction The rubber 8A consists of a single rubber composition,.and couples directly the rubber 8A and the rubber layer 8C with the belt 7.
[0019]The relation of the dynamic storage modulus described below between the way rubber layers 8B shall be realized here outside the rubber 8A of the center region Rc, and the both-sides field Rs. That is, under the temperature of 30 **, the frequency of 50 Hz, and the test condition of 1% of a dynamic strain, dynamic-storage-modulus E_A' of the rubber A of the center region Rc is compared with dynamic-storage-modulus E_B' of the way rubber layer 8B outside the both-sides field Rs, and has a bigger value.
[0020]The inner direction rubber layer 8C of the both-sides field Rs shall have physical properties whose tandelta on the temperature of 60 **, the frequency of 50 Hz, and the test condition of 1% of a dynamic strain is 0.1 or less. At this point, the inner direction rubber layer 8C is equivalent to conventional base rubber, and therefore, outside the both-sides field Rs, dynamic-storage-modulus E_B' of the way rubber layer 8B shall be compared with dynamic-storage-modulus E_C' of the inner direction rubber layer 8C, and shall have a bigger value.
[0021]Now, when slip angle 1 degree is given to the slick tire which rolls under loading, The relation between the grounding width position of tread part 2 tread to ground and the lateral force (side force) to generate is solved by actual Measurement Division, the lateral force generated in a grounding center region so that clearly from drawing 2 in which the result is shown as a plot diagram compares with the lateral force generated in a both-ends field, and it turns out that it is remarkably large. The lateral force generated as the whole tire is expressed with the area (N) surrounded by a plot diagram. The numerals e are the straight lines on a tire equatorial plane.
[0022]The tire 1 provided with the tread rubber 8 described above, First, based on the plot diagram shown in drawing 2, since dynamic-storage-modulus E_A' of the rubber 8A of the center region Rc of the tread rubber 8 is the maximum in the tread rubber 8, it turns out that it can generate and the lateral force at a minute steering angle with the big tire 1 is excelled in rectilinear-propagation steering stability.
[0023]Next, the input from a portion with high tread ground pressure of the tread part 2 under the loading of the tire 1 had influence dominantly, and in the case of the radial ply tire, the ground pressure of the both-sides field Rs compared with it of the center region Rc, and, as for the sound (R/N) in the car, solved the higher thing.
[0024]Therefore, even if the affecting degree to a sound (R/N) in the car arranges the rubber A of high dynamic-storage-modulus E_A' to the small center region Rc, Outside the both-sides field Rs, dynamic-storage-modulus E_B' of the way rubber layer 8B and dynamic-storage-modulus E_C' of the inner direction rubber layer 8C compare with dynamic-storage-modulus E_A' of the rubber A of the center region Rc, and are alike in it being a smaller value, and an in-the-car sound (R/N) level reduces the tire 1 more.

[0025]Even if it finally arranges the rubber 8A of high dynamic-storage-modulus E_A' to the center region Rc, The method rubber layer 8B of outside absorbs the rolling-resistance increment, and further dynamic-storage-modulus E_C' of the inner direction rubber layer 8C of the both-sides field Rs, When it compares with dynamic-storage-modulus E_B' of the way rubber layer 8B outside the both-sides field Rs, and it is a smaller value and tandelta of the inner direction rubber layer 8C is 0.1 or less, low rolling-resistance performance of the tire 1 improves.
[0026]As stated above, the tire 1 provided with the tread rubber 8 can raise these 3 performance simultaneously, without making all of three performances of rolling-resistance performance, a sound (R/N) in the car, and rectilinear-propagation steering stability into a sacrifice.
[0027]As for the value of each upper dynamic storage modulus, that the rubber 8A of the center region Rc has dynamic-storage-modulus E_A' of 12 or more MPa, and the way rubber layer 8B has dynamic-storage-modulus E_B' of 11 or less MPa outside the both-sides field Rs under the above-mentioned test condition actually suits the improvement in simultaneous of said three performances. Especially application of the rubber 8A of the center region Rc with dynamic-storage-modulus E_A' of 12 or more MPa demonstrates the rectilinear-propagation steering stability which can be detected also with a common driver.
[0028]Here, in less than 12 MPa, since rectilinear-propagation steering stability, especially the rectilinear-propagation steering stability in a minute steering angle fall here, dynamic-storage-modulus E_A' of the rubber 8A of the center region Rc is improper. If dynamic-storage-modulus E_B' of the way rubber layer 8B exceeds 11MPa outside the both-sides field Rs, since rolling resistance will increase and an in-the-car sound (R/N) level will go up, it is improper.
[0029]That the method rubber layer 8B of outside occupies the gauge of 60 to 90% of within the limits, and the inner direction rubber layer 8C occupies the gauge of 10 to 40% of within the limits to the gauge of the tread rubber 8 in the both-sides field Rs suits the improvement in simultaneous of said three performances.
[0030]Since rolling resistance will increase if rectilinear-propagation steering stability falls [the rate over the gauge of the tread rubber 8] here at less than 60% about the gauge of the method rubber layer 8B of outside and a rate exceeds 90%, all are improper. Since rectilinear-propagation steering stability will fall if rolling resistance increases in less than 10% in the rate over the gauge of the tread rubber 8 and a rate exceeds 40% about the gauge of the inner direction rubber layer 8C, all are improper.
[0031]The rubber 8A of the center region Rc shall have two tread parts of 10 to 20% of within the limits of the grounding width (previous explanation is followed) of the tread part 2. It is the width of the center region Rc shown in this width, i.e., drawing 1, and each **** is located on a flat surface parallel to tire equatorial plane E. Thereby, the improvement in simultaneous of said three performances will become much more positive.
[0032]Since rolling-resistance performance and a sound (R/N) in the car will stop at undesirable performance if it becomes insufficient [less than 10% of the grounding width of the tread part 2] rectilinear-propagation steering stability's improving the rubber 8A of the center region Rc and it exceeds 20% here, all are improper.
[0033]In order to aim at reduction of a sound (R/N) in the car further, here, As shown in drawing 1, as for the belt 7, having the tread part 2 hoop-direction arrangement rubber covering organic fiber code layer 9 more than a wrap couple (the example of a graphic display is a couple) from the method of the outside of a tire radial direction suits the code intersection layer 7-1 more than two-layer (the example of a graphic display is two-layer), 7-2, and the code intersection layer 7-1 and the both-sides end of 7-2.
[0034]The rubber coated cord of each class points out the laminated constitution which crosses mutually on both sides of tire equatorial plane E in the code intersection layer 7-1 and 7-2, and a steel cord suits this code. Preferably the hoop direction arrangement organic fiber code layer 9 one or more Two or more organic fiber codes, For example, suppose that it is good either to consider it as the layer which carried out spiral winding of the strip whose width, such as nylon cords, a polyester cord, and a rayon code, is 4-15 mm, or to use the layer of the prescribed width of the cord layer 9 as winding and the layer made to overlap. Even if it uses this cord layer 9, rectilinear-propagation steering stability does not fall to the center region Rc of the tread rubber 8 by applying the rubber 8A.

[Translation done.]

EXAMPLE

[Example]With the radial ply tire for passenger cars, sizes are 205/65R15 and composition applies to the place shown in drawing 1 correspondingly. The radial carcass 6 has 1 ply which arranged the polyester cord of the rubber covering 1500D/2 at about 90 degrees to the equatorial plane E of the tire 1. The belt 7 has the two-layer code intersection layer 7-1, and 7-2 and the top hoop direction arrangement organic fiber code layer 9 of a couple.
[0036]The code intersection layer 7-1 and the code of 7-2 applied the steel cord of 1x3x0.23 structure, and each steel cord was taken as 22-degree tilted arrangement to tire equatorial plane E. The cord layer 9 is two-layer [which carried out spiral winding of the strip which put in order five nylon cords of 1260D/2].
[0037]The tread rubber 8 was considered as the following composition.
Width of the center region Rc : (1) 42.5% of the width:grounding width of 15% of grounding width, and the both-sides field Rs. (2) Dynamic-storage-modulus E_B':9MPa of dynamic-storage-modulus E_A':20MPa of the rubber A, and the (3) rubber layer 8B, (4) The gauge ratio of gauge ratio:75% of the rubber layers 8B to tandelta:0.1 of the dynamic-storage-modulus E_C':3MPa (5) rubber layer 8C of the rubber layer 8C, and the gauge of the (6) tread rubber 8, and the rubber layer 8C : 25%.
However, each dynamic-storage-modulus E_A', E_B', E_C', and tandelta were measured using the spectrometer made from Oriental energy machinery.
[0038]In order to evaluate the effect of the working example tire, the conventional example tire which tread rubber was removed and also was doubled with the working example tire was prepared. The tread rubber of the conventional example tire was made into a cap/base structure, the same rubber as the rubber layer 8B of the working example tire was applied to the cap, and the same rubber as the rubber layer 8C of the working example tire was applied to the base.
[0039]The three following kinds of tests were carried out by using the tire of the two above-mentioned examples as a sample offering tire.
(1) Rolling-resistance test : it is filled up with internal pressure 200kPa, press each tire against the drum 1.7 m in diameter which rotates at 60 km/h under the load of load 4.9kN, and measure rolling resistance. Expressing the measurement result with the index which sets a conventional example tire to 100, the value presupposed that smallness I see is good.
(2) In-the-car sound (R/N) test : all the rings of the passenger car of the displacement 2.5L were equipped, and the sound (R/N) in the car in the front seat when it runs the asphalt road surface top containing a ball of a test course at 40 km/h was measured. Expressing the measurement result with the index which sets a conventional example tire to 100, the value presupposed that smallness I see is good.
(3) Rectilinear-propagation steering stability test : all the rings of the passenger car of the displacement 2.5L were equipped, and grading evaluation of the conventional example tire was carried out as the index set to 100 with the feeling when run the highway top at 80-100 km/h. Size I see of a value is good.
[0040]85 and a sound (R/N) in the car are [90 and the rectilinear-propagation steering stability of the index number of the working example tire by the above-mentioned test result of rolling resistance] 105. this result to the working example tire -- any of three performances of rolling-resistance performance, in-the-car sound (R/N) performance, and rectilinear-propagation steering stability -- although -- it turns out that it is improving simultaneously.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a sectional view of the pneumatic tire by this invention.
[Drawing 2]It is an explanatory view showing the generating degree of the lateral force in the grounding position of a tread part.
[Description of Notations]
1 Pneumatic tire
2 Tread part
3 Sidewall part
4 Bead part
5 Bead core
6 Radial carcass
6t folded section
7 Belt
7-1 and 7-2 Code intersection layer
8 Tread rubber
8A Center region rubber
8B The way rubber layer outside the both-sides field Rs
8C The inner direction rubber layer of the both-sides field Rs
9 Hoop direction arrangement organic fiber code layer
E Tire equatorial plane
Rc center region
Rs both-sides field

[Translation done.]

* NOTICES *

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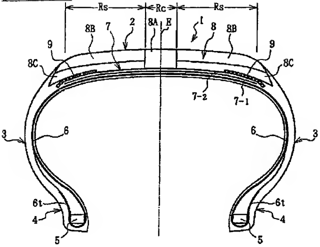
damages caused by the use of this translation.

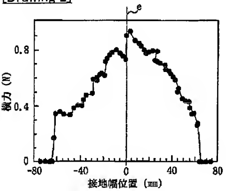
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号
特開2001－206013
（P2001－206013A）
(43)公開日　平成13年７月31日(2001.7.31)

(51)Int.Cl.7	識別記号	ＦＩ	テーマコード（参考）
Ｂ６０Ｃ　11/00		Ｂ６０Ｃ　11/00	Ｄ
			Ｂ
			Ｃ
9/22		9/22	Ｄ

審査請求　未請求　請求項の数６　ＯＬ　（全　６　頁）

(21)出願番号　特願2000－16509(P2000－16509)
(22)出願日　平成12年１月26日(2000.1.26)

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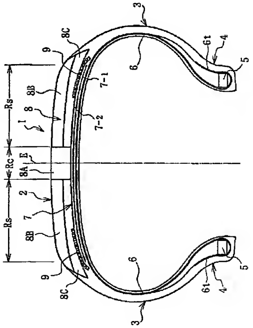
(54)【発明の名称】　空気入りタイヤ

(57)【要約】
【課題】　転がり抵抗性能、車内音（Ｒ／Ｎ）性能及び直進操縦安定性能の３性能を同時に向上させた空気入りタイヤを提供する。
【解決手段】　トレッドゴムはタイヤ赤道面を挟む中央領域ゴムとそれに連なる別種の両側領域ゴムとを有し、両側領域ゴムは外方のゴム層と内方の別種ゴム層との複合ゴム層構成を有し、中央領域ゴムの動的貯蔵弾性率E_A′は外方ゴム層の動的貯蔵弾性率E_B′より大きな値を有し、内方ゴム層はｔａｎδが０．１以下の物性を有する。



【特許請求の範囲】

【請求項１】　トレッド部と、その両側に連なる一対のサイドウォール部及び一対のビード部とを有し、これら各部をビード部内に埋設したビードコア相互間にわたり補強するラジアルカーカスと、該ラジアルカーカスの外周でトレッド部を強化するベルトとを備え、トレッド部は複数種のゴム組成物から構成するトレッドゴムを有する空気入りタイヤにおいて、
トレッドゴムは、タイヤ赤道面を挟む中央領域ゴムと、該ゴムに連なる別種の両側領域ゴムとを有し、
該両側領域ゴムは、タイヤ半径方向外方のゴム層と、その内方の別種ゴム層との複合ゴム層構成を有し、
温度３０℃、周波数５０Ｈｚ及び動的ひずみ１％の試験条件の下で、中央領域ゴムの動的貯蔵弾性率（E_A′）は、両側領域の外方ゴム層の動的貯蔵弾性率（E_B′）に比しより大きな値を有し、
両側領域の内方ゴム層は、温度６０℃、周波数５０Ｈｚ及び動的ひずみ１％の試験条件におけるｔａｎδが０．１以下である物性を有することを特徴とする空気入りタイヤ。

【請求項２】　上記の動的貯蔵弾性率の試験条件下にて、両側領域の外方ゴム層の動的貯蔵弾性率（E_B′）は、内方ゴム層の動的貯蔵弾性率（E_C′）に比しより大きな値を有する請求項１に記載したタイヤ。

【請求項３】　上記の動的貯蔵弾性率の試験条件下にて、中央領域ゴムは１２ＭＰａ以上の動的貯蔵弾性率（E_A′）を有し、両側領域の外方ゴム層は１１ＭＰａ以下の動的貯蔵弾性率（E_B′）を有する請求項１又は２に記載したタイヤ。

【請求項４】　両側領域のトレッドゴムゲージに対し、外方ゴム層は６０〜９０％の範囲内のゲージを占め、内方ゴム層は１０〜４０％の範囲内のゲージを占める請求項１〜３のいずれか一項に記載したタイヤ。

【請求項５】　中央領域ゴムは、トレッド部の接地幅の１０〜２０％の範囲内のトレッド部幅を有する請求項１〜４のいずれか一項に記載したタイヤ。

【請求項６】　ベルトは、２層以上のコード交差層と、該コード交差層の両側端部をタイヤ半径方向外方より覆う一対以上のトレッド部周方向配列有機繊維コード層とを有する請求項１に記載したタイヤ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、空気入りタイヤ、より詳細には乗用車や小型トラックなどの比較的小型車両の使途に供する空気入りラジアルタイヤに関し、特に、転がり抵抗性能、車内音（ロードノイズ、以下Ｒ／Ｎという）及び直進操縦安定性能を向上させた空気入りタイヤに関する。

【０００２】

【従来の技術】冒頭にて述べた小型車両に用いる空気入りタイヤには、転がり抵抗性能、車内音（Ｒ／Ｎ）、直進操縦安定性能などの諸性能がいずれも優れたレベルにあることが要求される。よって、従来、これらの諸性能向上手段が数多く提案されている。

【０００３】例えば、転がり抵抗性能向上手段、すなわち低転がり抵抗化手段として、トレッドゴムに、いわゆるキャップ／ベース構造を適用する手段が良く知られている。この構造は、トレッドゴムを２層化し、外層のキャップゴムにウエット性能や牽引性能に優れる、比較的ｔａｎδの値が大きいゴムを適用し、内層のベースゴムにヒステリシスロスが小さい、比較的ｔａｎδの値が小さい、例えば６０℃でｔａｎδが０．１以下のゴムを充当するものである。

【０００４】このキャップ／ベース構造のトレッドゴムを備えるタイヤは、それなりに低転がり抵抗化に寄与しているのは事実である。しかし、十分な低転がり抵抗性能を実現するためのベースゴムは、せん断剛性が低く、その結果、トレッド部の踏面で受けるグリップ力をベルトに伝達するとき時間遅れが生じ、直進操縦安定性能、特に、微小操舵角での操舵性能が低下する不具合をもたらす。

【０００５】上記のキャップ／ベース構造はトレッド部全幅にわたるものであり、これ以外に、トレッド部中央領域を除く部両側領域のトレッドゴム部分にのみキャップ／ベース構造を適用する手段も知られている。この別構造は、転がり抵抗はトレッド部のショルダ領域の寄与率が高いことから提案されたものである。

【０００６】また、車内音（Ｒ／Ｎ）の低減手段には、例えば、前述のキャップゴムに硬度が低いゴム、乃至は動的貯蔵弾性率Ｅ′が小さい、例えば、３０℃でＥ′が１１ＭＰａ以下のゴムを適用することが提案されている。しかし、キャップゴムを用いても、依然ベースゴムの前述した力の伝達遅れの問題を抱えている。この問題解決のため、キャップゴムに高硬度ゴム、乃至高動的貯蔵弾性率Ｅ′ゴムを適用すれば、振動乗心地性能や転がり抵抗性能が低下する問題が生じる。

【０００７】他の車内音（Ｒ／Ｎ）の低減手段として、ベルトの両側端部の外方を別途の一対の補強コード層により覆い、ベルト両側端部を強化する構造が提案され、この構造は車内音（Ｒ／Ｎ）低減に有効であることが知られている。しかし、この種の強化ベルト構造は、ベルト中央部の剛性が両側部の剛性に比しより小さくなるため、直進操縦安定性能が低下するという問題を伴う。

【０００８】

【発明が解決しようとする課題】以上詳述したように、従来技術では、転がり抵抗性能、車内音（Ｒ／Ｎ）及び直進操縦安定性能のうちの一性能を向上させようとすれば、残余の性能の低下が余儀なくされるという問題が生じ、今日、この問題を全面解決する手段が望まれている。

【0009】従って、この発明の請求項1～6に記載した発明は、特に、冒頭で述べた比較的小型車両の空気入りタイヤに関し、転がり抵抗性能、車内音（R／N）及び直進操縦安定性能の3性能を同時に向上させることができる空気入りタイヤを提供することを目的とする。

【0010】

【課題を解決するための手段】上記目的を達成するため、この発明の請求項1に記載した発明は、トレッド部と、その両側に連なる一対のサイドウォール部及び一対のビード部とを有し、これら各部をビード部内に埋設したビードコア相互間にわたり補強するラジアルカーカスと、該ラジアルカーカスの外周でトレッド部を強化するベルトとを備え、トレッド部は複数種のゴム組成物から構成するトレッドゴムを有する空気入りタイヤにおいて、トレッドゴムは、タイヤ赤道面を挟む中央領域ゴムと、該ゴムに連なる別種の両側領域ゴムとを有し、該両側領域ゴムは、タイヤ半径方向外方のゴム層と、その内方の別種ゴム層との複合ゴム層構成を有し、温度30℃、周波数50Hz及び動的ひずみ1%の試験条件の下で、中央領域ゴムの動的貯蔵弾性率E_A′は、両側領域の外方ゴム層の動的貯蔵弾性率E_B′に比しより大きな値を有し、両側領域の内方ゴム層は、温度60℃、周波数50Hz及び動的ひずみ1%の試験条件におけるtanδが0．1以下である物性を有することを特徴とする空気入りタイヤである。

【0011】ここに、上記動的貯蔵弾性率E_A′、E_B′及びtanδは、JIS K 7198(1991)の試験方法に記載された方法に従い求める値である。以下に述べる動的貯蔵弾性率E_C′についても同じである。

【0012】請求項1に記載した発明に関し、請求項2に記載した発明のように、上記の動的貯蔵弾性率の試験条件下にて、両側領域の外方ゴム層の動的貯蔵弾性率E_B′は、内方ゴム層の動的貯蔵弾性率E_C′に比しより大きな値を有する。

【0013】請求項1、2に記載した発明に関し、請求項3に記載した発明のように、上記の動的貯蔵弾性率の試験条件下にて、中央領域ゴムは12MPa以上の動的貯蔵弾性率E_A′を有し、両側領域の外方ゴム層は11MPa以下の動的貯蔵弾性率E_B′を有する。

【0014】請求項1～3に記載した発明に関し、請求項4に記載した発明のように、両側領域のトレッドゴムゲージに対し、外方ゴム層は60～90%の範囲内のゲージを占め、内方ゴム層は10～40%の範囲内のゲージを占め、請求項1～4に記載した発明に関し、請求項5に記載した発明のように、中央領域ゴムは、トレッド部の接地幅の10～20%の範囲内のトレッド部幅を有する。ここに、接地幅とは、JATMA YEAR BOOK(1999)、一般情報の章、用語の定義に記載した接地幅に従うものとし、ただし、記載内容中の規定の空気圧は、最大負荷能力に対応する最高空気圧とし、規定の質量は最大負荷能力とする。以下同じである。

【0015】また、請求項1に記載した発明に関し、請求項6に記載した発明のように、ベルトは、2層以上のコード交差層と、該コード交差層の両側端部をタイヤ半径方向外方より覆う一対以上のトレッド部周方向配列有機繊維コード層とを有する。

【0016】

【発明の実施の形態】以下、この発明の実施の形態を図1に基づき説明する。図1は、この発明の空気入りタイヤの断面図である。図1において、空気入りタイヤ（以下タイヤという）1は、トレッド部2と、その両側に連なる一対のサイドウォール部3及び一対のビード部4とを有する。

【0017】また、タイヤ1は、ビード部4内に埋設したビードコア5相互間にわたり延びる1プライ以上、図示例は1プライのラジアルカーカス6と、ラジアルカーカス6の外周にベルト7とを有する。ラジアルカーカス6は上記各部2～4を補強し、ベルト7はトレッド部2を強化する。ラジアルカーカス6は、ナイロンコード、ポリエステルコード、レーヨンコードなどの有機繊維コードのゴム被覆ラジアル配列になるプライから成る。図1に示すラジアルカーカス6は、ビードコア5の周りをタイヤ1の内側から外側に折返す折返し部6t を備える。

【0018】トレッド部2は、複数種のゴム組成物から構成するトレッドゴム8を備える。トレッドゴム8は、タイヤ赤道面Eを挟む中央領域Rc のゴム8Aと、その両側領域Rs のゴム8B、8Cとを有する。ゴム8B、8Cはトレッド部2周方向に沿ってゴム8Aに連なる。ゴム8A、8B、8Cはそれぞれ別種のゴム組成物から成る。両側領域Rs のゴム8B、8Cは、タイヤ1の半径方向（以下半径方向という）外方のゴム層8Bと、その内方のゴム層8Cとの複合ゴム層構成を有するものとする。ゴム8Aは単一ゴム組成物からなり、ゴム8Aとゴム層8Cとはベルト7に直接結合する。

【0019】ここに、中央領域Rc のゴム8Aと両側領域Rs の外方ゴム層8Bとの間で、次に述べる動的貯蔵弾性率の関係が成り立つものとする。すなわち、温度30℃、周波数50Hz、動的ひずみ1%の試験条件の下で、中央領域Rc のゴムAの動的貯蔵弾性率E_A′は、両側領域Rs の外方ゴム層8Bの動的貯蔵弾性率E_B′に比しより大きな値を有する。

【0020】また、両側領域Rs の内方ゴム層8Cは、温度60℃、周波数50Hz及び動的ひずみ1%の試験条件におけるtanδが0．1以下である物性を有するものとする。この点で、内方ゴム層8Cは従来のベースゴムに相当し、よって、両側領域Rs の外方ゴム層8Bの動的貯蔵弾性率E_B′は、内方ゴム層8Cの動的貯蔵弾性率E_C′に比しより大きな値を有するものとする。

【0021】さて、荷重負荷の下で転動するスリックタ

イヤにスリップアングル1°を付したとき、接地するトレッド部2踏面の接地幅位置と発生する横力（サイドフォース）との関係を実際の計測により解明し、その結果をプロット線図として示す図2から明らかなように、接地中央領域で発生する横力が両端領域で発生する横力に比し著しく大きいことが分かる。タイヤ全体として発生する横力はプロット線図で囲まれる面積（N）であらわす。なお、符号eはタイヤ赤道面上の直線である。

【0022】以上述べたトレッドゴム8を備えるタイヤ1は、まず、図2に示すプロット線図に基づき、トレッドゴム8の中央領域Rc のゴム8Aの動的貯蔵弾性率E_A′がトレッドゴム8中で最大であるから、タイヤ1は、微小操舵角度にて大きな横力を発生することができ、直進操縦安定性能に優れていることが分かる。

【0023】次に、車内音（R／N）は、タイヤ1の荷重負荷の下でのトレッド部2の踏面接地圧が高い部分からの入力が支配的に影響を及ぼし、ラジアルプライタイヤの場合は、両側領域Rs の接地圧が中央領域Rc のそれに比しより高いことを解明した。

【0024】よって、車内音（R／N）に対する影響度合いが小さい中央領域Rc に高い動的貯蔵弾性率E_A′のゴムAを配置しても、両側領域Rs の外方ゴム層8Bの動的貯蔵弾性率E_B′及び内方ゴム層8Cの動的貯蔵弾性率E_C′が、中央領域Rc のゴムAの動的貯蔵弾性率E_A′に比しより小さい値であるとにより、タイヤ1は、車内音（R／N）レベルが低減する。

【0025】最後に、中央領域Rc に高い動的貯蔵弾性率E_A′のゴム8Aを配置しても、その転がり抵抗増加分を外方ゴム層8Bが吸収し、さらに、両側領域Rs の内方ゴム層8Cの動的貯蔵弾性率E_C′が、両側領域Rs の外方ゴム層8Bの動的貯蔵弾性率E_B′に比しより小さい値であり、かつ、内方ゴム層8Cのｔａｎδが０．１以下であることにより、タイヤ1は低転がり抵抗性能が向上する。

【0026】以上述べたように、トレッドゴム8を備えるタイヤ1は、転がり抵抗性能、車内音（R／N）及び直進操縦安定性能の3性能のいずれも犠牲にすることなく、これら3性能を同時に向上させることができる。

【0027】実際上の各動的貯蔵弾性率の値は、前述の試験条件下にて、中央領域Rc のゴム8Aが１２ＭＰａ以上の動的貯蔵弾性率E_A′を有し、両側領域Rs の外方ゴム層8Bが１１ＭＰａ以下の動的貯蔵弾性率E_B′を有するのが、前記3性能の同時向上に適合する。特に、１２ＭＰａ以上の動的貯蔵弾性率E_A′をもつ中央領域Rc のゴム8Aの適用は、一般のドライバでも検知し得る直進操縦安定性能を発揮する。

【0028】ここに、中央領域Rc のゴム8Aの動的貯蔵弾性率E_A′が１２ＭＰａ未満では、直進操縦安定性能、特に、微小操舵角度での直進操縦安定性能が低下するので不可である。また、両側領域Rs の外方ゴム層8Bの動的貯蔵弾性率E_B′が１１ＭＰａを超えると、転がり抵抗が増加し、車内音（R／N）レベルが上昇するので不可である。

【0029】また、両側領域Rs におけるトレッドゴム8のゲージに対し、外方ゴム層8Bは６０～９０％の範囲内のゲージを占め、内方ゴム層8Cは１０～４０％の範囲内のゲージを占めるのが、前記3性能の同時向上に適合する。

【0030】ここに、外方ゴム層8Bのゲージに関し、トレッドゴム8のゲージに対する割合が６０％未満では、直進操縦安定性能が低下し、割合が９０％を超えると転がり抵抗が増加するのでいずれも不可である。内方ゴム層8Cのゲージに関しては、トレッドゴム8のゲージに対する割合が１０％未満では、転がり抵抗が増加し、割合が４０％を超えると直進操縦安定性能が低下するので、いずれも不可である。

【0031】また、中央領域Rc のゴム8Aは、トレッド部2の接地幅（先の説明に従う）の１０～２０％の範囲内のトレッド部2幅を有するものとする。この幅はすなわち図1に示す中央領域Rc の幅であり、各幅端はタイヤ赤道面Eと平行な平面上に位置する。これにより、前記3性能の同時向上はより一層確実なものとなる。

【0032】ここに、中央領域Rc のゴム8Aが、トレッド部2の接地幅の１０％未満では、直進操縦安定性能の向上が不十分となり、２０％を超えると転がり抵抗性能と車内音（R／N）とが不所望の性能に止まるのでいずれも不可である。

【0033】ここで、より一層車内音（R／N）の低減を図るには、図1に示すように、ベルト7は、2層以上（図示例は2層）のコード交差層7-1、7-2と、コード交差層7-1、7-2の両側端部をタイヤ半径方向外方より覆う一対以上（図示例は一対）のトレッド部2周方向配列ゴム被覆有機繊維コード層9とを有するのが適合する。

【0034】コード交差層7-1、7-2とは、各層のゴム被覆コードがタイヤ赤道面Eを挟んで互いに交差する積層構成を指し、このコードにはスチールコードが適合する。また、周方向配列有機繊維コード層9は、1本以上、好ましくは2本以上の有機繊維コード、例えばナイロンコード、ポリエステルコード、レーヨンコードなどの、幅が４～１５ｍｍのストリップを螺旋巻回した層とすること、又はコード層9の所定幅の層を巻回し、オーバーラップさせる層とすることのいずれも可とする。このコード層9を用いても、トレッドゴム8の中央領域Rc にゴム8Aを適用することで直進操縦安定性能が低下することはない。

【0035】

【実施例】乗用車用ラジアルプライタイヤで、サイズが２０５／６５Ｒ１５であり、構成は図1に示すところに準じる。ラジアルカーカス6は、ゴム被覆１５００Ｄ／

2のポリエステルコードをタイヤ1の赤道面Eに対し約90°で配列した1プライを有する。ベルト7は、2層のコード交差層7-1、7-2と一対の幅狭周方向配列有機繊維コード層9とを有する。

【0036】コード交差層7-1、7-2のコードは、1×3×0．23構造のスチールコードを適用し、各スチールコードはタイヤ赤道面Eに対し22°の傾斜配列とした。また、コード層9は、1260D／2のナイロンコードを5本並べたストリップを螺旋巻回した2層である。

【0037】トレッドゴム8は以下の構成とした。

（1）中央領域Rc の幅：接地幅の15％、両側領域Rs の幅：接地幅の42．5％、

（2）ゴムAの動的貯蔵弾性率E_A′：20MPa、

（3）ゴム層8Bの動的貯蔵弾性率E_B′：9MPa、

（4）ゴム層8Cの動的貯蔵弾性率E_C′：3MPa

（5）ゴム層8Cのtanδ：0．1、

（6）トレッドゴム8のゲージに対するゴム層8Bのゲージ比率：75％、ゴム層8Cのゲージ比率：25％。

ただし、各動的貯蔵弾性率E_A′、E_B′、E_C′及びtanδは、東洋精機械製スペクトロメータを用いて測定した。

【0038】実施例タイヤの効果を評価するため、トレッドゴムを除く他は実施例タイヤに合わせた従来例タイヤを準備した。従来例タイヤのトレッドゴムはキャップ／ベース構造とし、キャップには実施例タイヤのゴム層8Bと同一ゴムを適用し、ベースには実施例タイヤのゴム層8Cと同一ゴムを適用した。

【0039】上記2例のタイヤを供試タイヤとして下記3種類のテストを実施した。

（1）転がり抵抗テスト：内圧200kPaを充てんし、荷重4．9kNの負荷の下で60km/hで回転する直径1．7mのドラムに各タイヤを押し当て、転がり抵抗を測定する。測定結果は従来例タイヤを100とする指数にてあらわし、値は小なるほど良いとした。

（2）車内音（R／N）テスト：排気量2．5Lの乗用車の全輪に装着し、テストコースの玉石入りアスファルト路面上を40km/hで走行したときの前席での車内音（R／N）を測定した。測定結果は従来例タイヤを100とする指数にてあらわし、値は小なるほど良いとした。

（3）直進操縦安定性能テスト：排気量2．5Lの乗用車の全輪に装着し、高速道路上を80～100km/hで走行したときのフィーリングにより、従来例タイヤを100とする指数にて採点評価した。値は大なるほど良い。

【0040】上記のテスト結果による実施例タイヤの指数値は、転がり抵抗が85、車内音（R／N）が90、直進操縦安定性能が105である。この結果から、実施例タイヤは、転がり抵抗性能、車内音（R／N）性能及び直進操縦安定性能の3性能のいずれもが同時に向上していることが分かる。

【0041】

【発明の効果】この発明の請求項1～6に記載した発明によれば、転がり抵抗性能、車内音（R／N）性能及び直進操縦安定性能の3性能をいずれも同時に向上させることが可能な空気入りタイヤを提供することができる。

【図面の簡単な説明】

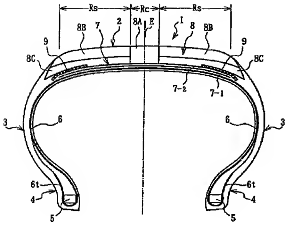
【図1】　この発明による空気入りタイヤの断面図である。

【図2】　トレッド部の接地位置における横力の発生度合いを示す説明図である。

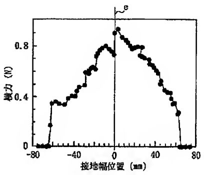
【符号の説明】

1　空気入りタイヤ
2　トレッド部
3　サイドウォール部
4　ビード部
5　ビードコア
6　ラジアルカーカス
6t　折返し部
7　ベルト
7-1、7-2　コード交差層
8　トレッドゴム
8A　中央領域ゴム
8B　両側領域Rs の外方ゴム層
8C　両側領域Rs の内方ゴム層
9　周方向配列有機繊維コード層
E　タイヤ赤道面
Rc　中央領域
Rs　両側領域

【図1】


Rs
Rc
Rs
8B
7
2
8A
E
1
8
8B
9
9
8C
8C
7-2
7-1
3
6
6
3
6t
6t
4
4
5
5

【図2】


e
0.8
0.4
0
-80
-40
0
40
80
接地幅位置 (mm)